

A REVISED SYNOPSIS OF THE PINES 5: THE SUBGENERA OF *PINUS*, AND
THEIR MORPHOLOGY AND BEHAVIOR

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ABSTRACT

Seven subgenera of *Pinus* are proposed on the basis of morphological and behavioral characters. The taxonomic separations are made by detaching special species or groups of species from the two older subgenera *Pinus* and *Strobus*. From subgenus *Pinus*, three "new" subgenera are detached: *Pinea*, *Sabinia*, and *Tamaulipasa*. From subgenus *Strobus*, two "new" subgenera are detached: *Gerardia* and *Balfouria*. Clear keys are given: one morphological, the other proposing behavioral differences.

KEY WORDS: *Pinus*, Pinaceae, systematics

INTRODUCTION

Starting with a brief history of the nomenclature, we recall that Koehne (1893, pp. 28, 30) keyed the pines according to only two basic groups: The *Diploxyylon* or "Hard Pines" with needles having two vascular bundles, and the *Haploxyylon* or "Soft Pines" having only one vascular bundle in their needles. Then Shaw (1914, pp. 1, 24, 25) accepted totally Koehne's taxonomy, but he preferred to set his key otherwise: instead of mentioning the vascular bundles, he mentioned that the said two subgenera "are even more accurately characterized" by the fact that in *Diploxyylon* the bases of the "fascicle-bracts" that subtend the sheaths wrapping the lower parts of the needles are decurrent on the shoots, while in *Haploxyylon*, the said bases are not decurrent on the shoots.

But recently Carvajal & McVaugh (1992, pp. 38, 50, 95) reported that that system does not hold very well. In some of the *Haploxyylon* species (with only one vascular bundle), namely the Piñon Pines and *Pinus rzedowskii* Madrigal & Caballero, the situation differs. By the end of the current growing season

and during the following autumn and winter, "it is usually evident that the said bases are indeed decurrent".

Nevertheless, in accordance with well established custom, our key presented here below retains the same basic division, while specifying that 1) the distinction between the the number of vascular bundles is discarded, 2) the easy to observe distinction of the decurrence is retained, 3) but we must also look at the recently elongated section of the twig as it appears at the end of the growth season and during the next autumn (dead season).

More precisely we recall that the said "recently elongated section of the twig" is also termed "young shoot" or "current season's twig" in modern botanical literature. It must also be understood that the end of the growth season varies according to latitude and altitude. However, it can be witnessed by the state of development of the winter buds situated at the very tip of the twig. Fully grown buds, no longer increasing in size, indicate that the growth season is over.

Many manuals, including that of Krussmann (1985, p. 207), show a drawing of both striped ("furrowed") shoots due to the decurrent bases, and smooth shoots due to the non decurrent bases. Photos are also helpful, and here we present Photo 1 of the striped shoot of *Pinus sylvestris* L., and Photo 2 of the smooth shoot of *Pinus strobus* L.

Then, within each basic division, we key further subgenera, which we distinguish according to the easy-to-see characters of the cones and seeds. Yes, the mature cones are generally easy to observe and the fundamental seed types (wing present or absent, long or short, retained or not) can be found readily when one looks at the interior side of the cone scale, where the seed marks and the wing marks (if they exist) are evident.

A behavioral key is furnished to justify the morphological one. It consists of an attempt to show the interaction of both time and efficiency with morphology.

Logic-wise it is systematically more practical to divide a genus of about 98 species into more subgenera than the two previously recognized ones. We are thus proposing seven. Each "new" subgenus includes extraordinary species or groups of species, well and clearly defined.

MORPHOLOGICAL KEY

- A. Twigs (aged one year older than current season's) striped (photo 1). ..B
 - B. Cones with double concentric umbos.subgenus *Pinea*
 - BB. Cones with simple umbos.C
 - C. Umbos all around the middle of the cones are terminal, long (at least 5 mm) and stout.subgenus *Sabinia*



Figure 1. *Pinus sylvestris*, one-year old twig showing the striped rough surface constituted by the decurrent needle sheaths.



Figure 2. *Pinus strobus*, showing the smoother surface resulting from the non-decurrent needle sheaths. Even the twig's two-year old section is smooth except that the small bumps are bigger. Shaw (1914, p. 1) cautions the reader that the difference between those two characters is better seen on long, vigorous twigs because the intervals between the needle sheaths (or fascicles) are wider.

- CC. Umbos at least on the interior face of the cones are dorsal, short (at most 5 mm) and small.D
 D. Cones sessile or with short peduncle, or with long, thin peduncle turning less than 60°.subgenus *Pinus*
 DD. Cones with long, thick peduncle turning at least 60°.subgenus *Tamaulipasa*
- AA. Twigs (aged one year older than current season's) smooth (photo 2). E
 E. Seeds three times longer than broad.subgenus *Gerardia*
 EE. Seed at most twice longer than broad.F
 F. Umbos terminal.subgenus *Strobis*
 FF. Umbos dorsal.subgenus *Balfouria*

ESSENTIAL BIBLIOGRAPHY

Below are listed the first valid publications of the above subgeneric names:

Pinus subgenus *Pinea* (Endlicher) Landry, *Nat. Canad.* 101(5):774. 1974.

Pinus subgenus *Sabinia* E. Murray, *Kalmia* 13:18. 1983.

Pinus subgenus *Pinus* from genus *Pinus* Linné, *Sp. Pl.* 1000. 1753.

Pinus subgenus **Tamaulipasa** P. Landry, *subgenus novum*

Curvus pedunculorum strobilorum 60° vel pluribus. Strobilorum juniorum crescentia trimestris. Folia connata. Monotypicum: *Pinus nelsonii* Shaw.

The curve of the cone peduncles turns at least 60°. Conelets mature over three months. Needles connate, i.e., fused. Named after the State of Tamaulipas, berth of the species.

Pinus subgenus *Gerardia* E. Murray, *Kalmia* 13:13. 1983.

Pinus subgenus *Strobis* Lemmon, *Handb. West-Amer. Cone-Bearers*, ed. 3. 20. 1893.

Pinus subgenus *Balfouria* E. Murray, *Kalmia* 13:11. 1983.

EXCLUDED NAME

Subgenus *Ducampopinus* (A. Chevalier) de Ferré *ex* Critchfield & Little, U.S. Dept. Agric. Misc. Pub. No. 991. 5. 1966.

The plant represented by this name does not belong in the genus *Pinus*. It belongs to *Ducampopinus* A. Chevalier, Rev. Bot. Appl. D'Agr. Trop. 24:30. 1944. Distinguishing features are the "frog's head" apophysis, the flat, lanceolate leaves smooth on one side, scabrous on the other, the different wood anatomy (absence of ray tracheids), etc. The main reference is Gausson (1960, pp. 40, 93, 94, and 99), who relates *Ducampopinus* to *Pinus*, but also to *Pseudolarix* and *Keteleeria*.

BEHAVIORAL KEY

- A. Branchlets with thicker, more protective bark. B.
- B. Cones take more than 2 years to mature. subgenus *Pinea*
- BB. Cones mature in about $1\frac{1}{4}$ years. C.
- C. Apophyses grow longitudinally from large conelets, about 4 cm long. subgenus *Sabinia*
- CC. Apophyses grow radially from small conelets, about 2 cm long.
- D.
- D. Non vertical cones, less effective at dispersal.
- subgenus *Pinus*
- DD. Vertical cones, better seed dissemination.
- subgenus *Tamaulipasa*
- AA. Branchlets with thin, less protective bark. F.
- F. Seed fusiform, thinner, penetrates the soil more deeply.
- subgenus *Gerardia*
- FF. Seed more ovoid, broader, penetrates the soil less easily. G
- G. Apophyses grow longitudinally. subgenus *Strobus*
- GG. Apophyses grow radially and take less time to do so.
- subgenus *Balfouria*

RECOGNITION

Due to their classicism, we have well relied on the two complete monographs of *Pinus* published during this century, those of George Russell Shaw (1914) and Henri Gaussen (1960). The monograph of Little & Critchfield (1969) contains no species descriptions, but it is also very informative.

LITERATURE CITED

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